

Histogenesis study of skin in sheep

Sajjad Hejazi¹, Sina Yaghoubi*², Mohamadreza Delghandi², Farzin Javid³

1 - Department of anatomy, Faculty of Veterinary Medicine, Tabriz branch, Islamic Azad University, Tabriz, Iran.

2 – Graduation of veterinary, Faculty of Veterinary Medicine, Tabriz branch, Islamic Azad University, Tabriz, Iran

3– Veterinary Student, Faculty of Veterinary Medicine, Tabriz branch, Islamic Azad University, Tabriz, Iran.

*Corresponding author

Hejazi.sajjad@yahoo.com

Abstract: Aim of this research is based on the study of face's skin in ((ghezel)) sheep. This study done on 100 sheep embryos. Mentioned embryos were sampled accidentally from Tabriz mechanized slaughter's house. Length of the collected embryo's were measured by $X=2.1(Y+17)$ formula. Collected embryos were in the age of 40 to 130 days. After fixation of embryos in 10% formalin, samples from face (including single hair follicle's and sensitive hair follicles) gathered. After providing the histological samples and using hematoxylin-eosin coloring method, samples studied. In the first levels of developing the skin, epidermis layer was provided from a layer of basal (cuboidal cells) and covered by a layer of squamous cells called periderm. In the 8th week of pregnancy, interstitial layer was created because of germinal layer's proliferation and in the 14th week of pregnancy the interstitial layer changed to a layer of spinous cells. In the last one-third of the pregnancy form of the skin changed to keratinized. Appearing the hair follicles, fat glands and sweat glands started in 9th week. Fat and sweat glands disconnected from hair follicle and simultaneously, myoepithelial cells appeared with sweat glands. Against all of the mammals that hair follicle grows by beveled angle, in sheep we are faced with perpendicular form of hair growth, in conclusion it's clear that the 13th week of ewe's embryo's life is a sensitive period for appearing skin structures. While melanocytes, myoepithelial cells, fat and sweat glands appear in this week. From results of this research, it's clear that the development pattern of ewe's embryo's skin is in accordance with human embryo.

[Hejazi S, Yaghoubi S, Delghandi M, Javid F. **Histogenesis study of skin in sheep.** *Life Sci J* 2013;10(5s):194-198] (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 35

Keyword: Histogenesis, Sheep, Skin

1. INTRODUCTION

Skin is the heaviest organ of body by having 16% of its weight. Skin is made of epidermis which have a layer of epithelial cells that originate from ectoderm and derm and a layer of connective tissue that originates from mesoderm. Under skin, hypoderm or under skin tissue is located and its made of loose connective tissue, also a group of cells called fat-paniklus can be included in this layer. In fact, hypoderm is not accounted as a part of skin, never and less it connects the skin as a layer of loose connective tissue to the layers of under it, also this layer is in accordance with superficial fascia in anatomy.(6). At all, in developed skin, derm makes the thickest part, and hair follicle, sweat and fat glands are located on the deep part of the derma. Animal's skin has two origins:

1: superficial layer for epidermis which is the improved form of superficial ectoderm.

2: deeper layer or derma which is provided from the develop of sub mesenchymal layer. Some usual parts of skin like hair follicle and sweat gland (apocrine in domestic animals) are placed in this area (5). In embryo's first growth levels, epiderm is covered with a single layer of epithelium and later they become a layer of periderm cells. (10,15). Derma is derivative of mesoderm and embryo's dermatomes. (12). In view of

embryology, hair, hoof, and horn (ruminants) are derivative of ectoderm layer (12). Hair follicles have differences according to the sex and weight of animal. (14) On the other hand, thickness of skin in sheep not only results from breed but also results from age, sex and weights. (11)



Figure 1: Some of the collected embryos for sampling

2. Method:

Statistical community in this research contains pregnant ewes from Ghezel's breed, which are killed in Tabriz mechanized slaughter. Samples include 100 male embryos which are disconnected from the uterus of pregnant ewes (Figure1). Sampling was completely random. After sampling age of the embryos measured,

with this formula $X=2.1(Y+17)$ in this formula "Y" means the length of embryo's body from head to butt (CRL). After determination of embryo's age, they placed in 10% formalin. Ages of the collected embryos were between 40 to 130 days. According to the 150 days of pregnancy period in ewes, samples categorized in 11 classes in 7, 8, and 9, 10, 11, 12, 13, 14, 15 weeks and forth month and fifth month. Sampling get done from the face area (figure 2).

After making a histological sections and coloring them by hematoxylin-eosin coloring method, samples were surveyed with light microscope.



Figure 2: Sampling from face area of embryo's face

3. Results:

Structure of skin in 7th week of pregnancy:

A layer made of thin layer with two cell layers called germinal and periderm, which is placed on the cuboidal cells of germinal cells in a squamous shape and taut way and connective mesenchymal layer with mesenchymal cells, were visible in the beneath layer (Figure 3).

Structure of skin in 8th week of pregnancy:

Germinal layer's cells were more visible. Because of the high mitosis activity, cells of this layer were compressed from side parts and were changed to small column from.

Superficial layer of cells was made of squamous periderm cells. Germinal layer was smooth and connected accepting high dose of dose of colors in most of germinal cell's cytoplasm in comparison by other cells, originates to the high mitosis activity in these cells. In the connective tissue under the germinal layer, cells of smooth muscles with taut nucleuses, euchromatic and little nucleus, and eosin filled cytoplasm were appeared.

Structure of skin in the 9th week of pregnancy:

Because of mitosis divides, cells of germinal layer made some places in connective mesenchymal tissue which makes epidermic crest. Nearly 5 rows of cells, made the middle layer of squamous cells.

Structure of skin in 10th week of pregnancy:

Epidermic crests were seen more than before with more distribution in the study of epiderm crest cells,

two groups of cells called peripheral and central were seen. Interstitial layer and periderm cells were like before. Capillaries were between epiderm crest cells. (Figure 5)

Structure of skin in 11th & 12th weeks of pregnancy:

Circumstance of epidermis germinal layer and interstitial layer and epidermis crests were like 10th week but blood vessels and smooth muscle cells placed in mesenchymal connective tissue showed a great increase.

Structure of skin in 13th week of pregnancy:

This week, melanocyte cells were clearly noticeable between germinal layer cells. These cells were placed in the distal part of primary hair follicles.

In primary hair follicles, for the first time fat glands with clear cytoplasm and u-chromatic nucleus and circle form appeared. In the distal part of primary hair follicle, sweat gland, simple columnar cells and myoepithelial cells appeared (Figures 6, 7).

Structure of skin in 14th week of pregnancy:

Interstitial layer cells slowly changed their form to spinous layer and spinous layer is easy to notice this week. Cells of hair follicle developed and a cuticle layer with hair follicle is provided.

Structure of skin in 15th week of pregnancy

Melanocyte cells are distributed between germinal cells in a way that melanin granules are completely conspicuous between first layers of spinous cells. This week sensitive hair follicles can be easily found in the reticular part of derm. Sensitive hair follicles can be easily found in the reticular part of derm. Sensitive hair follicle blood sinus was visible between papillary layer, reticular and dermis sheath.

Structure of skin in the 16th, 17th, and 18th weeks of pregnancy:

In all of these periods, all parts of the skin appeared and had a complete growth. In these periods granular cells become visible on spinous layer. Fat glands improved highly, sweat glands were near hair follicles. Beside of fat glands, arrector pili muscle was visible (Figure 9).

Structure of skins in 19th, 20th weeks of pregnancy:

Epidermis has the same condition as last weeks. Fat glands were near the hair follicles more than before. and sweat glands by comparison with weeks before were in their highest number. This week arrector pili muscle's cells near the sensitive hair follicle was remarkable, and they had lead to the reticular part of dermic sheath of derm. Accumulation of melanocytes in the cortex of hair follicle was noticeable; also all tissue layers of hair follicle were visible (Figure 10).

Schedule below shows the appearance time of embryo's skins tissue structures.

19	16				10						Appearance time(week)
20	17	15	14	13	11	9	8	7	Before7		Skin's structure
21	18				12						
										•	Germinal layer cells
										•	Capillaries under germinal layer
								•			Periderm layer
							•				Interstitial layer
							•				Smooth muscle cells
						•					Hair sprout
					•						Hair crest
				•							Primary hair follicle
				•							Fat glands
				•							Sweat glands
				•							Melanocyte
				•							Myoepithelial cells
			•								Keratinized layer
			•								Arrectore pili muscle
			•								Spinosal layer
		•									Desmozomic joints
		•									Sensitive hair follicle
		•									Sensitive hair's blood sinus
	•										Granolar layer
•										muscle of sensitive hair follicle

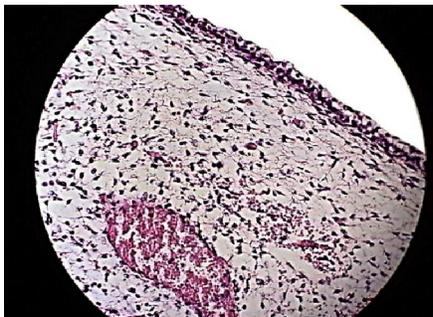


Figure 3: Section of embryo's skin tissue in week 7 Primary formation of periderm layer and appearance of connective tissue in derma.(hematoxilin – eosin coloring method) (Magnification * 40)

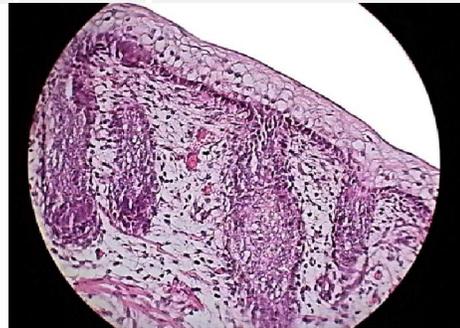


Figure 5: Section of embryo's skin tissue in week 10 Penetration of epiderm layer into the mesenchymal derm tissue and appearance of primary follicles growth plate. (hematoxilin -eosin coloring method) (Magnification*40)

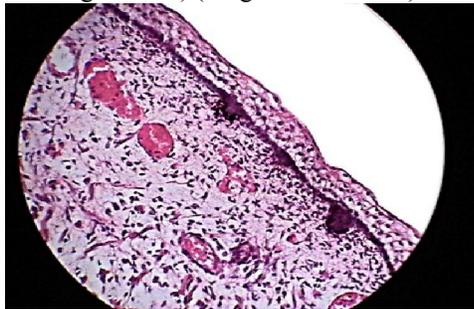


Figure 4: Section of embryo's skin tissue in week 9 Making up of the germinal cells accumulation and penetration to the tissue of mesenchymal derm (hematoxilin – eosin coloring method) (Magnification*40)

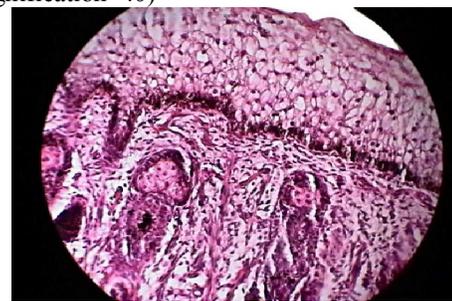


Figure 6: Section of embryo's skin tissue in week 13 Appearance of melanocytes in germinal layer and making up fat glands near the primary hair follicle growth plate (hematoxilin -eosin coloring method) (Magnification*40)

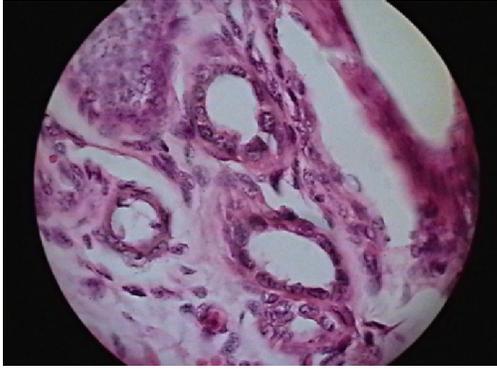


Figure 7: Section of embryo's skin tissue in week 14: Appearance of sweat glands near primary hair follicle's growth plates. (Hematoxilin & eosin coloring method) (Magnification*100)

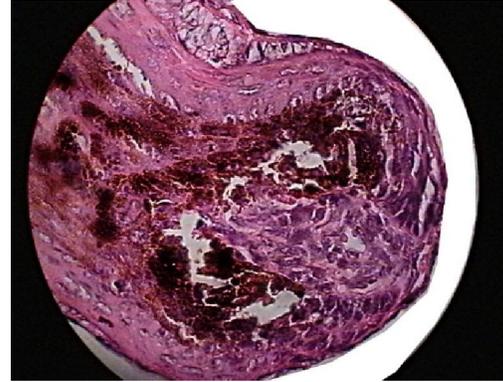


Figure 10: Section of embryo's hair's root in week20: Appearance of melanocytes in the Modula and cortex of hair's root. (Hematoxilin & eosin coloring method) (Magnification*100)

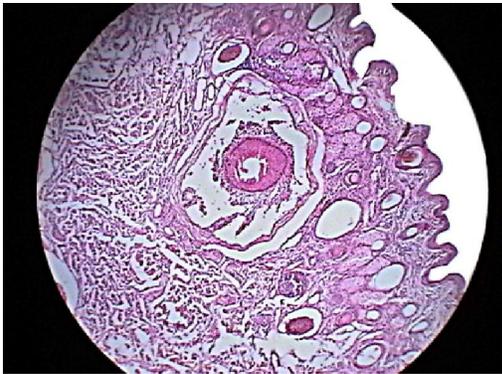


Figure 8: Section of embryo's skin tissue in week 15: Appearance of sensitive skin tissue in the depth of derma with primary hair follicle & fat glands. (Hematoxilin & eosin coloring method) (Magnification*10)

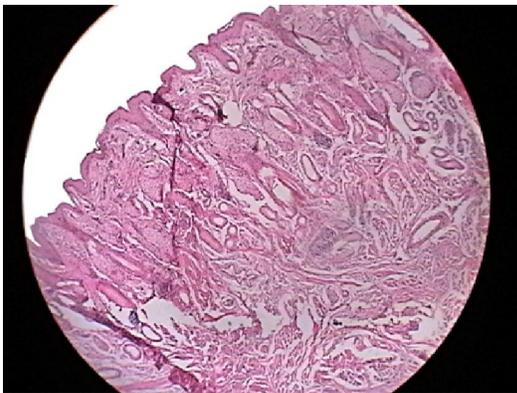


Figure 9: Section of embryo's skin tissue in week 17: Appearance of all structures related to skin with density of fat glands and smooth muscle. (Hematoxilin & eosin coloring method) (Magnification*10)

4. Discussion and Conclusion:

By studying the results and comparing them with other related resources of this topic, leads us to a deduction that epidermis of the skin is made of a single layer of fetus layers and by developing, it changed its form from simple squamus to non-keratinized stratified squamus and at the end, from week 13 to end it changes to keratinized stratifies squamus layer.

In other researches its written that firstly epidermis of embryo is covered with a single layer of ectoderm and continuously by cells dividing, a layer of epidermis appears on it.

At the beginning of second month, by division of germinal layer some classes of interstitial cells appears between two layers and at the last one-third of pregnancy, keratinized layer of epidermis appears.(12,15,16,17)

In the researches of "Maku"ian male fetus, its seen that, in the second month of pregnancy epiderm is just made of a single layer of cubical cells and later at the third month of growing the fetus, epiderm changes to stratified squamus form (18)

Germinal layer of skin changes a lot during growth period of embryo. In a way that, this layer seen with high density of cells and mitosis divides, and it results in appearing epidermic crests. These crests are the sources of hair follicles, fat and sweat glands.

From 9th week we are facing with penetration of basal layer into the depth of skin and continuously we see these cells in bigger shapes and different sizes, and it proves that cells develop and change their forms to hair follicle.fat and sweat glands. Researchers showed that hair's sprout showed itself as an accumulation of epidermis cells which penetrated to the derm beneath.(15,16,17)

After all, after making hair crest from hair sprout, some structures like fat glands develop (15, 17)

In the growth period, epiderm cells which make hair root are the same cells as germinal layer which continuously spreads and develops to other kind of cells (8) Fat glands and sweat glands of the skin are like a branch that originates from epidermic hair sprout. (4)

Because primary hair follicle, sweat and fat glands have the same appearance time in the 13th week of pregnancy, it's clear that they have close relation and same source from the view of embryology.

In researches on cow's fetus, it's seen that by growing, number of epiderm cells increase and the growth of hair follicles, sweat and fat glands, and arrectore pili muscle starts at 102,139,142,158 days (13).

In the other research it's mentioned that secondary sprout which is the first accumulation of sweat glands appears near the primary hair follicles on the fat glands. (10)

The research which was on "Maku"ian sheep breed, showed that fat glands originate from hair follicles near apocrine sweat glands. (18) This found is in accordance with "Schumer" study and possibly because of this research duct of this glands stay connected with hair follicle. (16)

Smooth muscle cells which have the duty of evacuating fat glands, are related to the development of fat glands and have the same timing, in a way that in the 9th week of pregnancy between accumulation of mesenchymal cells under epidermis crest we are faced with the developing of mesenchymal cells to muscle cells. And in the 11th and 12th week, number of smooth muscle cells, showed a great increase and this increase was in accordance with developing and growing of epidermis crest to fat cells.

Researches showed that by proliferation and changing epidermic crest in the back part of primary hair follicle, two kinds of cellular accumulation appears that first one is little and contains arrectore pili muscle cells, and the other one is the accumulation of fat glands. (10)

Smooth muscle cells which originated from mesenchymal are usually connected to the sheath of fat glands and they are called as arrectore pili muscle. (15)

Myoepithelial cells which have the related duty with fat cells simultaneously appear with sweat glands in the same week. As prediction, melanocytes appear between germinal layer's cells. (Week 13) and Modula of hair follicle.

Melanocyte is a special cell which is seen under or between germinal layers or in the hair follicle, (8,5) in a way that melanophore granules appear in the 3th month of pregnancy. (9)

After appearing Spinosal layer in 14th week, granolosa layer is the last class of epiderm layer which is seen in the developing growth of epiderm in 16th week.

Distribution pattern and capillary growth, spread to under epidermic crest by embryo's growth, in a way that capillaries spread to this area by developing of hair follicles, fat and sweat glands. Growth and spread of capillaries in 15th week make sensitive hair follicle blood sinuses. Studies showed that development of sensitive hair follicle happens in fetal period and it's similar to the development of primary follicle. (10, 12)

At all, 13th and 14th week of the fetus life have high sensitivity in skin's histogenesis and appearing most of its structures. In a way that primary hair follicle, fat and sweat glands, melanocytes, spinosal layer, keratinized layer, arrectore pili muscle, myoepithelial cells appear in those weeks. The best structure which is made on skin is sensitive hair follicle that appears in 15th week of fetal period.

References:

1. Hejazi, S. (2003): Stomach development in sheep. Tabriz branch of Islamic azad university, DVM thesis. No639.
2. Adibmorad, M. and Sheibani, M. (2000): Histology study of hair follicles in Rani goat skin. J. Faculty of Vet. Med. University of Tehran, 55(2): 75-78.
3. Brauer, Ph.R. (2004): Human Embryology. Hanley & Belfro, Canada, pp: 201-202.
4. Dellman, D.H. and Eurell, J. (1998): Veterinary Histology. 5th ed., Lippincott, USA, pp: 303-332.
5. Dyce, K.M., Sack, W.O. and Wensing, C.J. (1995): Textbook of Veterinary Anatomy. Saunders, London, pp: 353-354.
6. Galk, B.L., Jeyaseelan, K. and Wintour, E.M. (1994): Ontogeny of erythropoietin gene expression in the sheep fetes. Blood, 84(2): 460-466.
7. Junqueira, L. and Carneiro, J. (2003): Basic Histology. 10th ed., Mc Graw-Hill, USA, pp: 369-381.
8. Keith, L. (1998): Developing the Human, Clinically Oriented Embryology. 4th ed., W.B. Saunders, London, pp: 421-424.
9. McGeady, T.A., Quinn, P.J., Fitzpatrick, E.S. and Ryan, M.T. (2006): Veterinary Embryology. Blackwell, UK, pp: 313-322.
10. Muralidharan, M.R. (2002): Factors influencing skin thickness in sheep. Indian Vet. J., 79(3): 258-261.
11. Noden, D.M. and Lahunta, A. (1985): The Embryology of Domestic Animals. Williams & Winkins, London, pp: 181-186.
12. Panchal, K.M., Vyas, K.N. and Vyas, Y.L. (1999): Histogenesis of skin and its adnexa of Surti buffalo. Indian J. Vet. Ana., 11(2): 158-160.
13. Pelczynska, E. and Pyz-Lukasik, R. (2001): The relationship between hair structure, age and sex of animals, Zaleznosc miedzy budowa wlosow a wiekiem I plicia zwierzecia, Medycyna Weterynaryjna, 57(3): 175-177.
14. Sadler, T.W. (2004): Longman's Medical Embryology. 9th ed., Lippincott, USA, pp: 405-406.
15. Schumer, A., Wilkens, H., Volmerhours, B. and Habermenl, K.H. (1981): The Anatomy of the Domestic Animals, Verlag paul, Berlin, 3: 443-459.
16. Sengel, P. (1990): Skin development. Int. Journal Development Biology, 23: 33-50.
17. Shahruz, R. and Ahmadi, A. (2005): Histomorphometric study of skin in the sheep fetus, J. Vet. Res., University of Shiraz, 6 (3): 56-60.

2/24/2013